



LAWRENCE
LIVERMORE
NATIONAL
LABORATORY

Sister Lab Program Prospective Partner Nuclear Profile: Indonesia

Mo Bissani, Sean Tyson

January 12, 2007

Disclaimer

This document was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor the University of California nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or the University of California, and shall not be used for advertising or product endorsement purposes.

This work was performed under the auspices of the U.S. Department of Energy by University of California, Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

Sister Lab Program Prospective Partner Nuclear Profile: Indonesia

December 2006

1. Background

Indonesia has participated in cooperative technical programs with the IAEA since 1957, and has cooperated with regional partners in all of the traditional areas where nuclear science is employed: in medicine, public health (such as insect control and eradication programs), agriculture (e.g. development of improved varieties of rice), and the gas and oil industries. Recently, Indonesia has contributed significantly to the Reduced Enrichment Research and Training Reactor (RERTR) Program by conducting experiments to confirm the feasibility of Mo-99 production using high-density low enriched uranium (LEU) fuel, a primary goal of the RERTR Program.¹



Source: University of Texas Library, www.lib.utexas.edu/maps/cia06/indonesia_sm_2006.gif

Indonesia's first research reactor, the TRIGA Mark II at Bandung, began operation in 1964 at 250 kW and was subsequently upgraded in 1971 to 1 MW and further upgraded in 2000 to 2 MW. This reactor was joined by another TRIGA Mark II, the 100-kW Kartini-PPNY at Yogyakarta, in 1979, and by the 30-MW G.A. Siwabessy multipurpose reactor in Serpong, which achieved criticality in July 1983. A 10-MW radioisotope production reactor, to be called the RPI-10, also was proposed for construction at Serpong in the late 1990s,² but the project apparently was not carried out.

In the five decades since its nuclear research program began, Indonesia has trained a cadre of scientific and technical staff who not only operate and conduct research with the

current facilities, but also represent the nucleus of a skilled labor pool to support development of a nuclear power program.

Although Indonesia's previous on-again, off-again consideration of nuclear power has not gotten very far in the past, it now appears that Indonesia again is giving serious consideration to beginning a national nuclear energy program. In June 2006, Research and Technology Minister Kusmayanto Kadiman said that his ministry was currently putting the necessary procedures in place to speed up the project to acquire a nuclear power plant, indicating that, "We will need around five years to complete the project. If we can start the study, go to tender, and sign the contract for the project this year, the power plant could be on stream by 2011."³ While this ambitious schedule may be a bit unrealistic, it suggests new momentum to move forward on the project. The favored site for the proposed plant is the Muria Peninsula,⁴ located on Java's north central coast.

2. Technical Capabilities and Facilities

Indonesia has developed small-scale indigenous capabilities in many areas of the nuclear fuel cycle, although it has so far not pursued sensitive areas such as uranium isotope separation or spent-fuel reprocessing. Indonesia has been successful in establishing several significant nuclear facilities, and its research and development activities are supported by an extensive infrastructure of government facilities, research organizations, and university programs.

Uranium Deposits and Yellowcake Production Facilities

Exploration and Mining

Indonesia has conducted uranium exploration projects, with IAEA assistance, since the early 1980s and has identified uranium deposits thought to be sufficient uranium to meet the yellowcake requirements for its planned nuclear power reactors.⁵ According to the IAEA's World Distribution of Uranium Deposits Database,⁶ Indonesia's known uranium deposits, located in West Kalimantan, currently are dormant.

- The Remaja-Hitam ore body (also known as the Eko-Remaja prospect) is thought to contain 1,000 – 2,500 tons of uranium, with a grade of 0.2 - 0.5 percent uranium.
- The Rirang-Tanah Merah ore body is believed to contain less than 500 tons of uranium at 1 - 5 percent uranium.
- Production of uranium concentrate on a pilot-scale yellowcake using acid leaching and ion exchange was carried out by the Center for Development of Nuclear Ore and Geology at the Lemajung deposit from 1981 to 1986 with a design capacity of 0.2 tU/year.⁷

Center for Exploration and Processing of Nuclear Materials, Jakarta

With assistance from the IAEA Indonesia's National Nuclear Energy Agency (*Badan Tenaga Nuklir Nasional, or BATAN*),*, in 1985 completed a laboratory for uranium processing at the Center for Exploration and Processing of Nuclear Materials in Jakarta.⁸ One open source reports that “in 1985 this facility received about 175 [sic, no units indicated] of domestically mined uranium ore for processing.”⁹

Bandung Nuclear Complex

The Bandung Nuclear Complex, located adjacent to the Bandung Institute of Technology, is Indonesia's oldest nuclear center (established in the early 1960s) and is the site of the first of Indonesia's three research reactors.

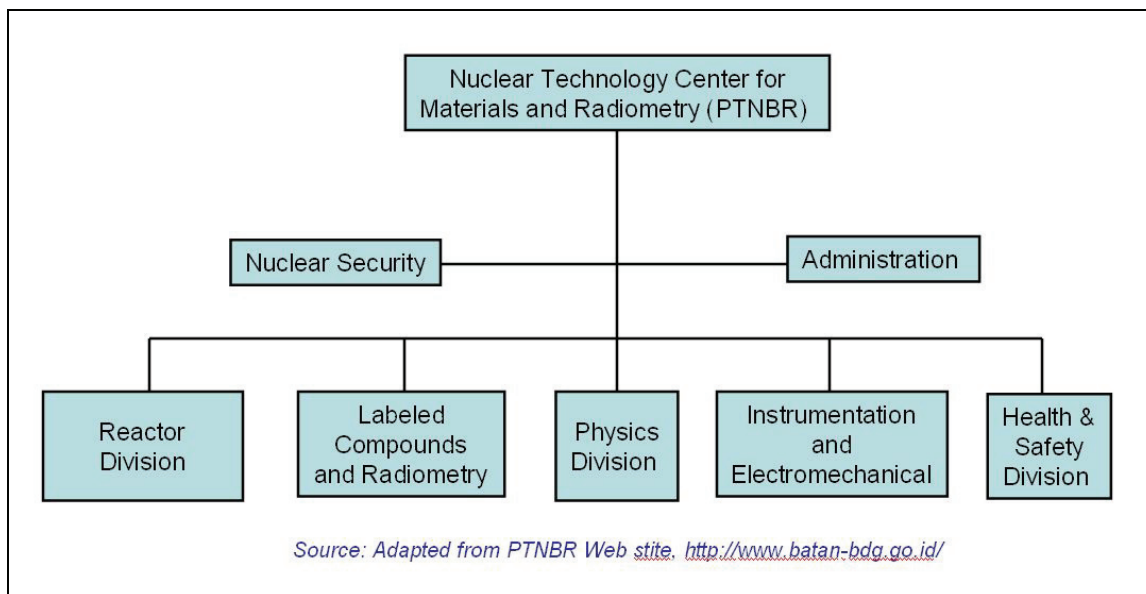


Bandung Nuclear Research Complex, Bandung. Image: DigitalGlobe via Google Earth) Building identifications adapted from: R. Parithusta, “Seismic Hazard Analysis for TRIGA 2000 Nuclear Site, Bandung,” 2nd Workshop on Earthquake Engineering for Nuclear Facilities, 2-14 February 2005, International Center for Theoretical Physics, Trieste).

The center has undergone several name changes over the years. Originally called the Bandung Nuclear Research Center (PRAB), the complex became Nuclear Technology Research Center (PPTN) in 1980, and in 1999 became the Center for Research and

* In addition to a National Nuclear Energy Agency, Indonesia has a separate national nuclear regulatory authority, BAPETEN, which was established by a 1997 parliamentary act.

Development of Nuclear Technology (P3TkN). Most recently, in a 2006 BATAN reorganization, the name was changed to the Nuclear Technology Center for Materials and Radiometry, or *Pusat Teknologi Nuklir Bahan dan Radiometri* (PTNBR). The organization chart below is adapted from the PTNBR Web site.¹⁰



Simplified organization chart for the Bandung nuclear research complex

The Center's Reactor Division operates the 2-MW Bandung TRIGA Mk II research reactor. The reactor achieved criticality 19 October 1964, and has since been used for radioisotope production, irradiation, physics experiments, and training. Its fuel was fabricated by General Atomics of the U.S.

In addition to the reactor and associated facilities, the Bandung center also has conducted activities related to nuclear fuel fabrication. By 1991, with assistance provided under two IAEA Technical Cooperation projects, the center had developed a capability to produce UO_2 powder from locally produced yellowcake, fabricate UO_2 pellets, and produce short (i.e., not of typical LWR fuel-rod length) fuel pins.¹¹ The Center's laboratories also are active in radiochemistry, radiobiology, and radiometallurgy.

Yogyakarta Nuclear Complex

BATAN's nuclear research complex at Yogyakarta is currently called the Center for Accelerator Technology and Material Processes, or PTAPB for its Indonesian name, *Pusat Teknologi Akselerator dan Proses Bahan*.^{*} The Center's Reactor Division operates the 100-kW Kartini TRIGA Mark II research reactor and an associated critical assembly. Other facilities include a laboratory for pure materials research, various accelerators, and laboratories for nuclear physics and chemistry. The Center's research activities include

^{*} The Center formerly was called the Center of Research and Development for Advanced Technology, or *Pusat Penelitian dan Pengembangan Teknologi Maju* (P3TM).

R&D in nuclear physics, chemistry, low- and medium-energy particle accelerator technology, process technology, analysis of nuclear materials, the use of the reactor for research and training.¹²



Center for Accelerator Technology and Material Processes (PTAPB), Yogyakarta, site of the Kartini research reactor. (Image: DigitalGlobe via Google Earth)

Serpong Nuclear Complex

The Serpong nuclear site is a diverse research complex for nuclear technology development. It contains centers for research, development, and engineering of nuclear science and technology. It was built from 1983 -1992 the objectives of supporting development of Indonesian nuclear industry and preparing for development and operation of nuclear power plants in Indonesia. The Serpong nuclear complex is located 25 km southwest of Jakarta and 3 km south of the town of Serpong, within the larger National Center for Research Science and Technology (PUSPIPTEK) complex. The main nuclear facility at the site is the 30-MW “G.A. Siwabessy” multipurpose reactor. Other significant installations include a laboratory for fabrication of power reactor fuel, a production facility for research reactor fuel elements, a Development Center for

Radioactive Waste Management, as well as facilities for radiometallurgy, reactor safety, neutron spectrometry, nuclear information, and computer technology.¹³



Serpong Nuclear Energy Research Establishment (Image: DigitalGlobe via Google Earth)

The 30-MW G.A. Siwabessy reactor is a German-built, pool-type materials test reactor, which first achieved criticality 29 July 1987, and has since been used for basic research, radioisotope and radiopharmaceutical production, material science, silicon doping, nuclear engineering activities, and education in reactor operation and maintenance. Its U₃O₈ fuel initially was supplied by Germany but now is fabricated at Serpong using imported 20% uranium. Exploratory efforts are underway to fabricate silicide fuel for the reactor.

In addition to research reactor fuel fabrication, the Serpong site also has a laboratory for fabrication of UO₂ fuel pellets and pins.

Radioactive waste treatment, storage, and disposal studies are all conducted at the nuclear Development Center for Radioactive Waste Management. In 1990, Indonesia, in collaboration with the IAEA, completed a six year project to improve its radioactive waste management program for the disposal of radioactive waste from its research reactors. Indonesia is currently thought to operate in accordance with international norms.

Pasar Jum'at Nuclear Center

The Center for the Application of Isotope and Radiation Technologies, or *Pusat Aplikasi Teknologi Isotop dan Radiasi* (PATIR),^{*} is located in the Pasar Jum'at area of southern Jakarta. It was established in 1966. The site includes no nuclear research reactor, but there are several cobalt-60 gamma irradiators (90 kCi, 60 kCi, 7.5 kCi, and 0.3 kCi) as well as electron beam sources for irradiation and isotope production technology. The center has a laboratory for nuclear safety and nuclear biomedicine, and provides nuclear-related education and training.¹⁴



Pasar Jum'at nuclear research center (Image: DigialGlobe via Google Earth)

3. Nuclear Power

A rapid increase in domestic energy demand, coupled with the limited sustainability of current resources, has led to a need for new sources of energy. While gas and oil will continue to be the main sources, the commissioning of nuclear power plants would help stabilize the supply of electricity and conserve oil and coal reserves.

A study on national energy planning was conducted in 2001. The study's objective was to support the planning and decision-making process in Indonesia's energy and electricity

^{*} Formerly called the Pasar Jumat Center for Nuclear Technology Research (PPTN-Pasar Jumat)

sectors, taking into account economic, environmental, and social aspects. The study team comprised members from the following Indonesian institutions: the Agency of Assessment and Application of Technology (BPPT), the National Nuclear Energy Agency (BATAN), the Directorate General of Electricity and Energy Development (DJPPE), the Directorate General of Oil and Gas (DJOGAS), the Environmental Impact Control Agency (BAPEDAL), the National Center for Statistics (BPS), the State Electricity Company (PT. PLN Persero), and the Non-Governmental Organization for Environment (NGO). The International Atomic Energy Agency (IAEA) assisted the Government of Indonesia in executing this study by giving aid in the form of computer software and assistance from its experts.

The results of this study provided a projection for energy demand taking into consideration population growth, economic growth, and technology. The Gas Base-load Plant was ranked first in technology for electricity generation. The Coal Base-load Plant came in second due to economically competitive electricity generation. Introduction of nuclear power will become more favorable as the use of fossil fuels is constrained and environmental standards are enforced; thus, nuclear power was ranked third in the study. The potential for growth in natural gas exports is promising, particularly if nuclear power is introduced in Java-Bali, allowing for a reduction in domestic consumption.

BAPETEN has prepared a roadmap for introducing the construction of nuclear power plants (Figure 2). The roadmap is derived from the National Energy Policy of 2004, and includes the following objectives:

- Assess the capability of the electrical grid to accommodate the electricity produced by NPPs.
- Reach a nuclear energy capacity of 6000-7000 MWe by 2025, meeting 6-7% of estimated total national electricity demand.
- Ensure that Act No. 20 (2002) concerning electricity is consistently applied.

Current plans estimate a first nuclear power reactor will be built as early as 2011 (a somewhat unrealistically ambitious date) followed by at least four more by 2025.¹⁵ The vendor for the reactors has not been settled on, with offers being entertained from France, South Korea and Japan. The Indonesian government also plans to construct nuclear plants in remote and more rural areas, and to this end Russia has proposed floating nuclear reactors. Indonesia has expressed interest, but there has been little indication that it intends to move forward with this option.¹⁶

4. Nuclear Institutions

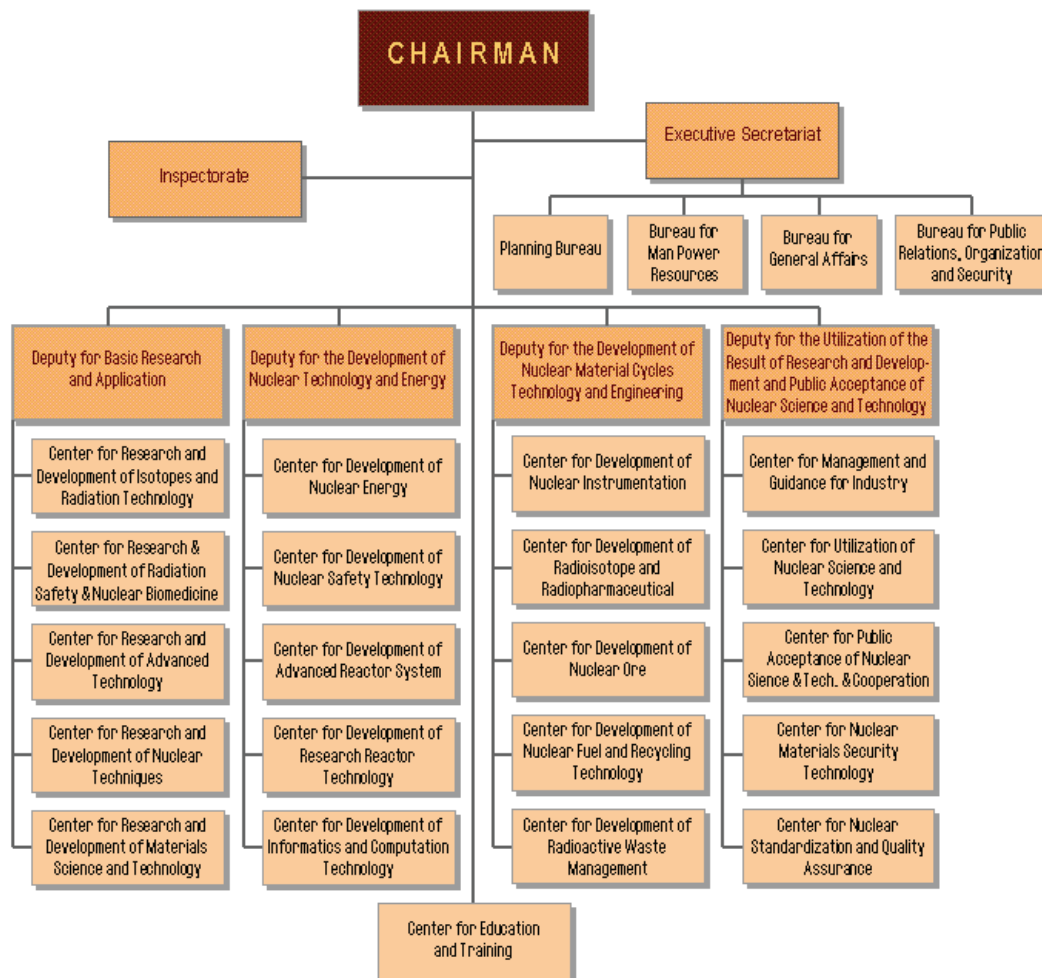
Nuclear Energy Control Board (NECB, or BAPETEN)

BAPETEN was established on 8 May 1998 by Presidential Decree No. 76, and began operations 1 January 1999.¹⁷ The Nuclear Energy Act of 1997 replaced Act No. 31 of 1964, declaring a requirement for the government to establish regulations, issue licenses, perform inspections, and undertake necessary enforcement in order to ensure the compliance of nuclear energy operators with safety regulations and requirements.

BAPETEN carries out these functions as an independent government agency that is responsible directly to the President of Indonesia.

National Nuclear Energy Agency (NNEA, or BATAN) ¹⁸

BATAN was also established by Presidential Decree No. 76. According to its website, BATAN is an independent government agency charged with supporting nuclear research and development that will contribute to the development of nuclear energy in Indonesia. BATAN supports training and maintaining a pool of experts in nuclear science and technology, and operating nuclear facilities that benefit agriculture, industry, and the scientific community.¹⁹



Source: BATAN, www.batan.go.id/batan.html

Other Institutions:

Other government institutions involved in nuclear policy and activities include the following, listed on the IAEA directory of Indonesia Nuclear Authorities.²⁰

Department of Mines and Energy (Jakarta)

The Department of Mines and Energy has regulatory authority over the uranium mines.

Ministry of State for Research and Technology

The State Ministry of Research and Technology was established in 1962. It has the responsibility to assist the President of the Republic of Indonesia in formulating national policies and implementing coordination in the field of research, science and technology. BATAN and BAPETAN are both non-departmental agencies that function beneath the Ministry, as do the Center for Research, Science and Technology (PUSPIPTK) and the Indonesian Institute of Sciences (LIPI).²¹

5. Bilateral and Multilateral Nuclear Technical Cooperation

Indonesia has a long history of technical cooperation with the IAEA and with other countries, both regional and around the globe. Its nuclear research program is well established, and spans nearly five decades. With four nuclear research facilities in operation (including three operational research reactors), a cadre of trained professionals and ties to the IAEA, foreign capitals, universities, and research labs, the country is able to offer a great deal of expertise across almost an entire spectrum to other states exploring nuclear technology.

Indonesia has sponsored the Asian Nuclear Safety Network (ANSN), a computer network jointly operated by BAPETEN and BATAN. The objective of the ANSN project is to pool and share existing and new technical knowledge and practical experience to further improve the safety of nuclear installations in Asia. The ANSN computer network is operated through eight ANSN National Centers in China, Indonesia, Japan, Korea, Malaysia, the Philippines, Thailand and Vietnam. Each National Center has a web site associated with it, which can provide access to information regarding nuclear safety and serves as a portal to other ANSN sites. ANSN can be searched locally or through the IAEA's web site.²²

In addition to projects conducted through the IAEA, Indonesian officials and technical staff have also recently been involved with the U.S. Department of Energy's International Radiological Threat Reduction (IRTR) Program.²³ At four nuclear sites, U.S. and Indonesian personnel implemented upgrades to the physical security and material accounting systems in place. All work was completed by FY 05, and projects associated with the four sites entered sustainability mode in FY 06.²⁴

5.1 National Projects:

Active National Projects (12)

<i>Project Number</i>	<i>Title</i>	<i>Field</i>	<i>1st Year of Approval</i>	<i>Country Officer</i>	<i>Project Responsible Officer</i>	<i>Technical Officer</i>	<i>Total Budget</i>
INS5030	Sustainable Agricultural Development in Yogyakarta	5A	2001	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Spencer, Marie Madeleine (NAFA) Lagoda, Pierre Jean Laurent (NAFA)	158510

INS5031	Mutation Breeding of Horticultural Crops	5C	2001	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Spencer, Marie Madeleine (NAFA) Miranda, Manoela Pessoa de (NAFA) Lagoda, Pierre Jean Laurent (NAFA)	180940
INS5032	Improving Beef and Dairy Cattle Production in Yogyakarta	5E	2001	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Boettcher, Paul John (NAFA) Vercoe, Philip Edward (NAFA)	120671
INS8023	Groundwater Resources Exploitation in the Gunung Kidul Area	8M	2001	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Ito, Mari (NAPC)	75627
INS0017	Human Resource Development and Nuclear Technology Support	0A	2003	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Dias, Mahendra Prinath (TCAP)	463374
INS6011	Detecting Drug-resistant Strains of Tuberculosis	6B	2003	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Khan, Baldip Kaur (NAHU)	267210
INS6012	Initiation of Radiotherapy Center in Kalimantan	6C	2003	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Rosenblatt, Eduardo (NAHU) McLean, Ian Donald (NAHU)	699456
INS9022	Inspection Procedures and Methods for Assessing Reactor Tank Liners	9M	2003	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Paranjpe, Shrinivas Krishnarao (NAPC) Ciuculescu, Cristina (NSNI)	457920
INS4033	Preparation for a Nuclear Power Plant	4V	2005	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Cheng, Huiping (NENP)	116980
INS4034	Feasibility Study for Nuclear Desalination Plant Construction	4X	2005	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Misra, Braj Mohan (NENP)	33790
INS4035	Preparation of Regulations, Codes, Guides and Standards for a Nuclear Power Plant	9H 0D	2005	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Gasparini, Marco (NSNI)	77280
INS7004	Utilization of Neutron Generator Accelerator for Environmental Monitoring	7L	2005	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Dytlewski, Nikolai (NAPC) Rossbach, Matthias H. (NAPC)	147990

Completed National Projects (123)

<i>Project Number</i>	<i>Title</i>	<i>Field</i>	<i>Completed on</i>	<i>Country Officer</i>	<i>Project Responsible Officer</i>	<i>Technical Officer</i>	<i>Total Budget</i>
INS9005	Environmental Radioactivity	9Q 9C	1976-10-01	Nataadidjaja, Erman (TC)			18802
INS4007	Reactor Engineering	4E	1977-10-12	Nataadidjaja, Erman (TC)			31214
INS3003	Raw Materials Prospection	3B	1977-12-22	Nataadidjaja, Erman (TC)			66344
INS5011	Radioisotopes in Animal Science	5E	1978-03-28	Nataadidjaja, Erman (TC)		Kumarasinghe, Kumarasinghe Saliya (NAFA)	30237
INS4011	Radiation Measurements Instrumentation	4G	1978-03-29	Nataadidjaja, Erman (TC)			64544
INS3004	Raw Materials Prospection	3B	1978-10-13	Nataadidjaja, Erman (TC)			82631
INS5014	Radioisotopes in Agriculture	5B	1979-10-10	Nataadidjaja, Erman (TC)		Nethsinghe, Douglas A. (TCPM)	14809
INS4009	Nuclear Metallurgy	4E	1980-02-22	Nataadidjaja, Erman (TC)		Colton, John P. (TCPC)	8562
INS5013	Mutation Breeding	5C	1980-02-22	Nataadidjaja, Erman (TC)		Kawai, Takeshi (NAFA)	36530
INS1006	Materials Research	1E	1980-05-20	Nataadidjaja, Erman (TC)		Dolnicar, Joze (NAPC)	47194
INS2007	Radiochemistry	2B	1980-05-20	Nataadidjaja, Erman (TC)		Yuan, Hong-Chien (TCAC)	24113
INS4014	Reactor Engineering	4D	1980-05-20	Nataadidjaja, Erman (TC)		Colton, John P. (TCPC)	6905
INS4016	Reactor Electronics	4G	1980-05-23	Nataadidjaja, Erman (TC)		Dolnicar, Joze (NAPC)	16116
INS1007	Nuclear Magnetic Resonance	1G	1980-07-14	Nataadidjaja, Erman (TC)		Dolnicar, Joze (NAPC)	35960
INS2006	X-Ray Fluorescence	2C	1980-08-26	Nataadidjaja, Erman (TC)		Dolnicar, Joze (NAPC)	46918

INS4013	Irradiation Studies Using King Furnace	4K	1980-08-26	Nataadidjaja, Erman (TC)	Colton, John P. (TCPC)	15558
INS5015	Fish Irradiation Preservation	5H	1980-09-25	Nataadidjaja, Erman (TC)	Loaharanu, Paisan (NAFA)	17203
INS5016	Radioisotopes in Animal Science	5E	1980-09-30	Nataadidjaja, Erman (TC)	Young, Bruce A. (NAFA) Dargie, James Donald (NAFA)	64766
INS2008	Labelled Compounds	2F	1981-09-08	Nataadidjaja, Erman (TC)	Vera Ruiz, Hernan Guido (NAPC)	12605
INS2009	Labelled Compounds	2F	1981-09-08	Nataadidjaja, Erman (TC)	Yuan, Hong-Chien (TCAC)	49453
INS4015	Nuclear Fuel Fabrication	4E	1981-09-08	Nataadidjaja, Erman (TC)	Colton, John P. (TCPC) Sukhanov, Georgy (NENP)	7432
INS8010	Radiation Processing	8H	1981-09-09	Nataadidjaja, Erman (TC)	Yuan, Hong-Chien (TCAC) Machi, Sueo (NA)	15372
INS8008	Consultancies on Radiation Processing for Industry	8H 8I	1982-06-30	Nethsinghe, Douglas A. (TCPM)	Yuan, Hong-Chien (TCAC)	12627
INS1011	Ion Implantation Technique	1G	1982-07-20	Nataadidjaja, Erman (TC)	Dolnicar, Joze (NAPC)	9018
INS3006	Uranium Exploration	3C	1982-07-20	Nataadidjaja, Erman (TC)	Tauchid, Mohamad (NEFW) Barretto de Campos, Paulo Marcos (TCPB)	34897
INS4012	Nuclear Electronics	4G	1982-07-20	Nataadidjaja, Erman (TC)	Dolnicar, Joze (NAPC) Vuister, Petrus Hendrikus (RILS)	27234
INS1008	Laser Instrumentation	1C	1983-09-23	Nataadidjaja, Erman (TC)	Dolnicar, Joze (NAPC)	27559
INS8009	Isotopes in Hydrology	8N	1983-09-23	Nataadidjaja, Erman (TC)	Payne, Bryan (NAPC)	3781
INS5017	Radioisotopes in Poultry Nutrition	5E	1983-11-21	Nataadidjaja, Erman (TC)	Dargie, James Donald (NAFA)	49151

INS4019	Nuclear Electronics	4G	1985-06-03	Nataadidjaja, Erman (TC)	Vuister, Petrus Hendrikus (RILS)	37757
INS1009	Secondary Standards Dosimetry Laboratory	1K	1985-06-25	Nataadidjaja, Erman (TC)	Haider, Johann Georg (TCPM)	34538
INS6003	Radioimmunoassay Services	6B	1985-06-25	Nataadidjaja, Erman (TC)	Dudley, Robert A. (RILS)	63653
INS1013	Nuclear Magnetic Resonance (NMR)	1G	1985-08-26	Nataadidjaja, Erman (TC)	Dolnicar, Joze (NAPC)	32067
INS3007	Uranium Ore Processing	3F	1985-10-21	Islam, Mohammad Mizanul (TCPA)	Ajuria Garza, Sergio (NENF) Tauchid, Mohamad (NEFW)	155868
INS1012	Neutron Scattering Study	1E	1986-06-27	Islam, Mohammad Mizanul (TCPA)	Dolnicar, Joze (NAPC)	28331
INS2010	Production of Radioimmunoassay Kits	2G 2F	1986-06-27	Islam, Mohammad Mizanul (TCPA)	Piyasena, Rienzil Dodwell (NAHU)	54129
INS8012	Neutron Radiography	8C 1L 4E	1986-07-25	Islam, Mohammad Mizanul (TCPA)	Muranaka, Richard George G. (NAPC)	10214
INS0006	Reorganization of Batan's Management and Administration	0G	1987-03-16	Nethsinghe, Douglas A. (TCPM)	Nethsinghe, Douglas A. (TCPM)	4602
INS0005	Nuclear Manpower Development	0I	1987-10-30	Islam, Mohammad Mizanul (TCPA)	L'Annunziata, Michael Frank (TC)	22251
INS3005	Nuclear Materials Analysis	3E	1987-10-30	Islam, Mohammad Mizanul (TCPA)	Noe, Maxy Charles (NENF)	57483
INS4020	Nuclear Instrument Maintenance	4G	1987-10-30	Islam, Mohammad Mizanul (TCPA)	Vuister, Petrus Hendrikus (RILS)	63607
INS1010	Secondary Standards Dosimetry Laboratory	1K	1988-12-19	Islam, Mohammad Mizanul (TCPA)	Haider, Johann Georg (TCPM)	326220
INS9009	Radiation Physics	6F 9C	1988-12-19	Islam, Mohammad Mizanul (TCPA)	Van Herk, Gerard (NAHU)	8419

INS5018	Agricultural Production	5A	1988-12-31	Nethsinghe, Douglas A. (TCPM)	Lachance, Leo E. (NAFA) Maluszynski, Miroslav (NAFA) Hance, Raymond John (NAFA)	1574988
INS0003	Nuclear Power Programme	0B	1989-06-15	Islam, Mohammad Mizanul (TCPA)	Molina, Pablo (NENP)	134493
INS8016	Radiation Technology in Packaging	8H 8I	1989-09-25	Islam, Mohammad Mizanul (TCPA)	Loaharanu, Paisan (NAFA)	8016
INS8011	Groundwater Hydrology	8M	1989-09-29	Islam, Mohammad Mizanul (TCPA)	Gonfiantini, Roberto (NAPC)	162836
INS0008	Nuclear Database Development	0J	1989-10-30	Islam, Mohammad Mizanul (TCPA)	Lemmel, Hans Dietrich (NAPC)	14811
INS1014	Use of Neutron Beam in Materials Research	1G	1989-10-30	Islam, Mohammad Mizanul (TCPA)	Muranaka, Richard George G. (NAPC)	218118
INS6005	Training Course on Radioimmunoassay	6B	1989-10-30	Islam, Mohammad Mizanul (TCPA)	Piyasena, Rienzil Dodwell (NAHU)	21415
INS9008	Environmental Radioactivity Laboratory	9G	1989-10-30	Islam, Mohammad Mizanul (TCPA)	Ahmed, Jasim Uddin (NENS)	159157
INS0004	Nuclear Materials Accounting	0C	1990-12-20	Islam, Mohammad Mizanul (TCPA)	Bates, Olan Gene Gene (SGDE)	87664
INS1017	Nuclear Analytical Techniques	1L 4A	1990-12-20	Islam, Mohammad Mizanul (TCPA)	Wang, Dahai (NAPC)	6116
INS4018	Reactor Physics	4D 1F	1990-12-20	Islam, Mohammad Mizanul (TCPA)	Crijns, Martinus J. (NEFW) Alcala-Ruiz, Francisco (NSNI)	256731
INS4021	Research Reactor Commissioning	4B 1F	1990-12-20	Islam, Mohammad Mizanul (TCPA)	Muranaka, Richard George G. (NAPC)	75664
INS3008	Uranium Exploration	3B	1990-12-22	Islam, Mohammad Mizanul (TCPA)	Tauchid, Mohamad (NEFW)	310762
INS8014	Industrial Biomass Conversion	8C	1990-12-22	Islam, Mohammad Mizanul (TCPA)	Markovic, Vitomir M. (NAPC)	112713

INS9006	Radioactive Waste Management	9E 4O	1990-12-27	Islam, Mohammad Mizanul (TCPA)	Squires, David J. (NENF) Ahmed, Jasim Uddin (NENS)	211010
INS9010	Underground Waste Disposal	4O	1991-12-10	Islam, Mohammad Mizanul (TCPA)	Squires, David J. (NENF)	55628
INS1016	Radionuclide Standardization	1K 1L	1991-12-17	Islam, Mohammad Mizanul (TCPA)	Haider, Johann Georg (TCPM)	114005
INS1018	Neutron Activation Analysis	1L 2C	1991-12-17	Islam, Mohammad Mizanul (TCPA)	Mani, Raghunath Subra (NAPC)	39133
INS4017	Fuel Element Technology	4E 4M	1991-12-17	Islam, Mohammad Mizanul (TCPA)	Chantoin, Pierre M. (NEPF)	150579
INS4025	Quality Assurance and Quality Control Programmes	4M	1991-12-17	Islam, Mohammad Mizanul (TCPA)	Pieroni, Nestor Baltasar (NENP)	151989
INS5020	Soil Water Management Studies	5B	1991-12-17	Islam, Mohammad Mizanul (TCPA)	Kumarasinghe, Kumarasinghege Saliya (NAFA)	68728
INS8015	Radiation Processing with an Electron Beam Machine	4H 8H	1991-12-31	Islam, Mohammad Mizanul (TCPA)	Markovic, Vitomir M. (NAPC)	459344
INS0010	Nuclear Information System	0F 0J	1992-12-30	Islam, Mohammad Mizanul (TCPA)	Taoka, Wesley M. (NESI)	31743
INS4026	Neutron Transmutation Doping of Silicon	4K 4B 4A	1992-12-30	Islam, Mohammad Mizanul (TCPA)	Akhtar, Khalid Mahmud (NAPC)	68993
INS6007	Quality Control and Maintenance of Nuclear Medical Equipment	6B 4G 4M	1992-12-30	Islam, Mohammad Mizanul (TCPA)	Xie, Yanfeng (NAHU)	87417
INS9014	Research Reactor Safety	9O 9H 4B	1992-12-30	Islam, Mohammad Mizanul (TCPA)	Alcala-Ruiz, Francisco (NSNI)	66773
INS3009	Uranium Exploration and Development	3C 3F	1994-04-18	Sun, Yizhen (TCPA)	Tauchid, Mohamad (NEFW)	350855
INS8013	Radiocarbon Dating	8O	1994-04-18	Sun, Yizhen (TCPA)	Rozanski, Kazimierz (NAML)	135082
INS0007	Energy Economics Calculations with Nuclear Options	0E	1994-05-25	Sun, Yizhen (TCPA)	Molina, Pablo (NENP)	145537
INS7002	Radiobiological Laboratory	7C 7I	1994-05-25	Sun, Yizhen (TCPA)	Mukherjee, Ramendra Nath (NAHU)	39146

INS9016	Environmental Radioactivity Measurements (Phase II)	9G	1994-05-25	Sun, Yizhen (TCPA)	Fujimoto, Kenzo (NENS) Stegnar, Peter (NSRW)	83663
INS9017	Establishment of a Decontamination Facility	9G	1994-05-25	Sun, Yizhen (TCPA)	Laraia, Michele (NEFW)	37906
INS1015	Utilization of Multi-Purpose Research Reactor	1L 0H	1994-10-27	Sun, Yizhen (TCPA)	Akhtar, Khalid Mahmud (NAPC)	436988
INS4023	Research Reactor Calculations and Experiments	4A 4C 4D 4B	1994-10-28	Sun, Yizhen (TCPA)	Akhtar, Khalid Mahmud (NAPC)	235137
INS4024	Cyclotron Production of Radionuclides	4H	1994-11-07	Sun, Yizhen (TCPA)	Vera Ruiz, Hernan Guido (NAPC)	146408
INS6006	Radiation Therapy	6C	1994-11-07	Sun, Yizhen (TCPA)	Llamas Mendoza, Augusto Jose (NAHU)	189007
INS5021	Agricultural Production, Phase II	5A	1995-04-24	Aslam, Javed (TCPA)	García Podesta, Mario (NAAL) Kumarasinghe, Saliya (NAFA)	446461
INS6009	Establishment of a Radioimmunoassay Laboratory	6B	1995-05-15	Sun, Yizhen (TCPA)	Piyasena, Rienzil Dodwell (NAHU)	68276
INS6008	Medical Physics	6F	1995-05-17	Sun, Yizhen (TCPA)	Llamas Mendoza, Augusto Jose (NAHU) Ortiz Lopez, Pedro (NSRW)	87814
INS9015	Regulatory Aspect of Radiation Protection	9C	1995-05-25	Sun, Yizhen (TCPA)	Griffith, Richard V. (NSRW) Stegnar, Peter (NSRW)	53655
INS4022	Experimental Silicide Fuel Element	4E	1995-05-30	Sun, Yizhen (TCPA)	Akhtar, Khalid Mahmud (NAPC)	115001
INS6004	Nuclear Medicine Services	6B	1995-06-30	Sun, Yizhen (TCPA)	Gopinathan Nair, Gopalan (NAHU)	119204
INS0009	Training in Nuclear Science and Technology	0I 1A 4A	1995-12-22	Sun, Yizhen (TCPA)	Walsh, Robin L. (NAPC)	349458

INS8017	Radiation Processing of Medical Products	8H	1995-12-22	Sun, Yizhen (TCPA)	Markovic, Vitomir M. (NAPC)	210852
INS8019	Isotopic Ratios in Geothermal Exploration	8M	1995-12-22	Sun, Yizhen (TCPA)	Gerardo-Abaya, Jane (TCLA)	226056
INS9013	Strengthening Nuclear Safety Infrastructure	9H	1995-12-22	Sun, Yizhen (TCPA)	Alcala-Ruiz, Francisco (NSNI) Mrabit, Khammar (NSRW)	86900
INS8018	Radiation Processing Technology	8H	1996-02-29	Sun, Yizhen (TCPA)	Markovic, Vitomir M. (NAPC)	153992
INS9019	Radiomedical Dosimetry	6F 9C	1996-07-26	Sun, Yizhen (TCPA)	Turai, Istvan (NSRW) Ortiz Lopez, Pedro (NSRW)	103374
INS1020	Neutron Scattering Data Processing	1E	1996-09-25	Sun, Yizhen (TCPA)	Dolan, Thomas (NSRW)	29565
INS2011	Production of Labelled Isotopes	2F	1996-09-25	Sun, Yizhen (TCPA)	Walsh, Michael A.R. (NAPC)	135024
INS4029	Upgrading Safety Instrumentation of Bandung Research Reactor	4G 4B 4D	1996-09-25	Sun, Yizhen (TCPA)	Dolan, Thomas (NSRW)	77834
INS9018	Internal Dosimetry Service	6F 9C	1996-09-30	Sun, Yizhen (TCPA)	Gustafsson, Monica (NSRW) Griffith, Richard V. (NSRW)	127320
INS0012	Energy Economic Calculations with Nuclear Option (Phase II)	0E	1996-10-29	Kita, Tomohiko (TCPA)	Molina, Pablo (NENP)	175542
INS0013	Manpower Development	0A	1996-10-29	Kita, Tomohiko (TCPA)		280597
INS1021	Utilization of Cyclotron	1L	1996-10-29	Kita, Tomohiko (TCPA)	Vera Ruiz, Hernan Guido (NAPC)	56278
INS4030	Research Reactor Calculations and Experiments - Phase II	4A 4D 4B	1996-10-29	Kita, Tomohiko (TCPA)	Dolan, Thomas (NSRW)	119985
INS2013	Instrumental Chemical Analysis	2C	1997-02-28	Kita, Tomohiko (TCPA)	Walsh, Michael A.R. (NAPC)	191518
INS4027	Reactor Physics Codes	4B	1997-09-27	Kita, Tomohiko (TCPA)	Dolan, Thomas (NSRW)	87034

INS9012	Nuclear Power Plant Siting	9F	1997-12-23	Kita, Tomohiko (TCPA)		Guerpinar, Aybars (NSNI) Lederman, Luis (NS)	727973
INS5025	Feasibility Study on Food Irradiation	5H	1998-08-28	Kita, Tomohiko (TCPA)		Loaharanu, Paisan (NAFA)	48245
INS0011	University Research and Teaching	0I 5A 4A	1998-11-12	Kita, Tomohiko (TCPA)		Salema, Manase Peter (TCAP)	383715
INS5024	Effective Use of Fertilizers in Rice Cultivation	5B	1998-12-11	Kita, Tomohiko (TCPA)		Serraj, Rachid (NAFA)	241703
INS5022	University Research and Teaching in Agriculture	5A	1999-09-14	Kita, Tomohiko (TCPA)		Salema, Manase Peter (TCAP)	380249
INS5023	Feed Supplementation for Increasing Livestock Production	5E	1999-11-30	Kita, Tomohiko (TCPA)		Perera, Buthgamu Mudiyansele Amithral Oswin (NAFA)	144756
INS7003	Radiation Sterilization of Human Tissue Grafts	7E	2000-08-30	Sun, Yizhen (TCPA)	Sun, Yizhen (TCPA)	Tatsuzaki, Hideo (NAHU)	255391
INS9020	Environmental Monitoring System Development	9K	2000-08-30	Sun, Yizhen (TCPA)	Sun, Yizhen (TCPA)	Winkler, Guenther Leopold (NS)	199044
INS0014	Manpower Development and Nuclear Technology Support	0I	2000-10-31	Sun, Yizhen (TCPA)	Sun, Yizhen (TCPA)	Khan, Asghar Ali (NAAL)	601383
INS6010	Maintenance of Co-60 Radiation Therapy Facilities	6A	2000-10-31	Sun, Yizhen (TCPA)	Sun, Yizhen (TCPA)	Pernicka, Frantisek (NAHU) Ortiz Lopez, Pedro (NSRW)	59856
INS5026	Mutation Breeding of Bananas	5C	2002-05-16	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Nichterlein, Karin (NAFA)	110747
INS4028	Support for the First Nuclear Power Plant	4C	2002-08-02	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Mazour, Thomas Joseph (NENP)	503767
INS4031	Radiation Waste Management Programme	4O	2002-08-02	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Burcl, Rudolf (NEFW)	60608
INS9021	NPP Site Confirmation and Structural Safety	9F	2002-08-02	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Guerpinar, Aybars (NSNI) Contri, Paolo (NSNI)	168633
INS3011	Uranium Exploration and Development Study	3E	2004-01-28	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Erdi-Krausz, Gabor (NEFW)	511125

INS5028	Biofertilizers to Increase Food Crop Yields from Acid Soil	5B	2004-01-28	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Moutonnet, Pierre (NAFA)	70764
INS5027	Mutation Breeding of Ornamental Plants	5C	2004-03-31	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Jain, Shri Mohan (NAFA)	51492
INS2014	Production of Advanced Radiopharmaceuticals	2G	2004-04-30	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Pillai, Maroor Raghavan Ambikalmajan (NAPC)	217154
INS0016	Comparative Assessment of Different Energy Sources for Electricity Generation	0E	2004-12-22	Sukasam, Kesrat (TCAP)	Rogner, Hans-Holger (NE)	Rogner, Hans-Holger (NE)	144778
INS0015	Human Resource Development and Nuclear Technology Support	0A	2005-01-31	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Dias, Mahendra Prinath (TCAP)	525724
INS8021	Pilot-Scale Demonstration of Biomaterial for Medical Care	8H	2005-01-31	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Chmielewski, Andrzej Grzegorz (NAPC)	75216
INS5029	Supplementary Feeding and Reproduction Management of Cattle	5E	2005-02-28	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Perera, Buthgamu Mudiyanseelage Amithral Oswin (NAFA) Makkar, Harinder Paul Singh (NAFA)	271010

Cancelled National Projects (9)

<i>Project Number</i>	<i>Title</i>	<i>Field</i>	<i>Cancelled On</i>	<i>Country Officer</i>	<i>Project Responsible Officer</i>	<i>Technical Officer</i>	<i>Total Budget</i>
INS5019	Neutron Irradiation Facility	5C 1L	1989-10-20	Islam, Mohammad Mizanul (TCPA)		Brunner, Helmut (NAAL) Micke, Alexander ()	0
INS9011	National Marine Radioactivity Research	9E	1991-10-15	Islam, Mohammad Mizanul (TCPA)		Mrabit, Khammar (NSRW)	0
INS1019	Standardization of Radionuclides	1K	1993-10-12	Sun, Yizhen (TCPA)		Haider, Johann Georg (TCPM)	0
INS1022	Design and Development of Neutron Generator	1L	1993-10-12	Sun, Yizhen (TCPA)		Wang, Dahai (NAPC)	0
INS2012	Radionuclides in Food and Environmental Samples	9K 2C 9Q	1993-10-12	Sun, Yizhen (TCPA)		Mani, Raghunath Subra (NAPC)	0

INS3010	Uranium Exploration and Development in Kalan	3C 3B 3F 8O	1993-10-12	Sun, Yizhen (TCPA)		Tauchid, Mohamad (NEFW)	0
INS8020	Isotope Fractionation for Radiocarbon Dating		1993-10-12	Sun, Yizhen (TCPA)		Rozanski, Kazimierz (NAML)	0
INS4032	Operation and Application of Low Energy Accelerators	4G	2000-12-13	Sun, Yizhen (TCPA)		Fazinic, Stjepko (NAPC)	0
INS8022	Radiotracers and Sealed Sources for Industry Application	8J	2003-11-01	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Jin, Joon-Ha (NAPC)	0

5.2 Regional/Interregional Projects:

Active Regional/Interregional Projects (56)

<i>Project Number</i>	<i>Title</i>	<i>Field</i>	<i>1st Year of Approval</i>	<i>Country Officer</i>	<i>Project Responsible Officer</i>	<i>Technical Officer</i>	<i>Total Budget</i>
INT0060	Technical Co-operation Between Developing Countries	0A	1995	Salema, Manase Peter (TCAP)		Salema, Manase Peter (TCAP)	946144
INT4131	Sustainable Technologies for Managing Radioactive Wastes	3H	1997	Kurghinyan, Vladimir (TCEU)	Kurghinyan, Vladimir (TCEU)	Al-Mughrabi, Mohamed (NEFW) Balla, Janos (NEFW) Kahraman, Alper (NEFW)	2565864
RAS6029	Distance-assisted Training for Nuclear Medicine Technicians (RCA)	6B	1997	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Dondi, Maurizio (NAHU) Watanabe, Naoyuki (NAHU)	636688
INT5145	Insect Pest Control Using the Sterile Insect Technique	5D	1999	Salema, Manase Peter (TCAP)		Hendrichs, Jorge Pedro (NAFA)	1936300
RAS5035	Improving Animal Productivity and Reproductive Efficiency (RCA)	5E	1999	Dias, Mahendra Prinath (TCAP)		Boettcher, Paul John (NAFA) Vercos, Philip Edward (NAFA)	1052981
RAS6033	Distance Education in Radiation Oncology (RCA)	6C	1999	Dias, Mahendra Prinath (TCAP)		Hendry, Jolyon Hindson (NAHU)	715200
RAS8084	Isotope Use in Managing and Protecting Drinking Water (RCA)	8M	1999	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Kulkarni, Kshitij Mahadev (NAPC)	589625

RAS9023	Legislation for Safe and Peaceful Nuclear Applications	0D 9C	1999	Lutfi, Nabil (TCAP)	Lutfi, Nabil (TCAP)	Vez Carmona, Maria de Lourdes (EXPO) Djermouni, Belkacem (NSRW)	327847
INT0074	Pre-Project Assistance (Africa and East Asia and the Pacific)	0A	2001	Salema, Manase Peter (TCAP)	Salema, Manase Peter (TCAP)	Salema, Manase Peter (TCAP)	539136
INT0076	Country Programme Review (Africa and East Asia and the Pacific)	0A	2001	Salema, Manase Peter (TCAP)	Salema, Manase Peter (TCAP)	Salema, Manase Peter (TCAP)	109200
RAS0032	Support Towards Self-Reliance and Sustainability of National Nuclear Institutions	0A	2001	Lutfi, Nabil (TCAP)	Lutfi, Nabil (TCAP)	Dias, Mahendra Prinath (TCAP) Lutfi, Nabil (TCAP)	660166
RAS5039	Restoration of Soil Fertility and Sustenance of Agricultural Productivity (RCA)	5B	2001	Dias, Mahendra Prinath (TCAP)		Zapata, Felipe (NAFA)	619203
RAS5040	Enhancement of Genetic Diversity in Food, Pulses, and Oil Crops and Establishment of Mutant Germplasm Network (RCA)	5C	2001	Dias, Mahendra Prinath (TCAP) Kim, Myung Ro (TCAP)		Shu, Qingyao (NAFA) Lokko, Yvonne Rosaline Naa (NAFA) Lagoda, Pierre Jean Laurent (NAFA)	607540
RAS6034	Quality Assurance Programme for Molecular-Based Diagnosis of Infectious Diseases	6B	2001	Kamel, Reyad Sherif (TCAP)	Kamel, Reyad Sherif (TCAP)	Khan, Baldip Kaur (NAHU)	863110
RAS8091	Process Diagnostics and Optimization in Petrochemical Industry (RCA)	8J	2001	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Jin, Joon-Ha (NAPC) Einav, Isaac (NAPC)	723375
RAS8092	Investigating Environment and Water Resources in Geothermal Areas (RCA)	8M	2001	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Kulkarni, Kshitij Mahadev (NAPC)	287826
RAS8093	Use of Isotopes in Dam Safety and Dam Sustainability (RCA)	8N	2001	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Araguas Araguas, Luis Jesus (NAPC) Kurtas, Tuerker (NAPC)	307631
RAS9026	National Regulatory Control and Occupational Radiation Protection Programmes	9C	2001	Dey, Sujit (TCAP)	Dey, Sujit (TCAP)	Mrabit, Khammar (NSRW) O'Donnell Torroba, Patricio Alfonso (NSRW)	1719895

RAS9027	Development of Technical Capabilities for Sustainable Radiation and Waste Safety Infrastructure	9E 9C	2001	Dey, Sujit (TCAP)	Dey, Sujit (TCAP)	Mrabit, Khammar (NSRW) O'Donnell Torroba, Patricio Alfonso (NSRW)	2277735
INT6052	Improving the Quality of Production and Uses of Radiation Sterilized Tissue Grafts	6B	2002	Salema, Manase Peter (TCAP)		Hendry, Jolyon Hindson (NAHU)	844860
INT4141	Status and Prospects of Development for and Applications of Innovative Reactor Concepts for Developing Countries	4C	2003	Cardoso Cabezon, Alain Jorge (TCEU)	Cardoso Cabezon, Alain Jorge (TCEU)	Kuznetsov, Vladimir (NENP)	883991
INT5148	Establishing Quality Systems in Veterinary Testing Laboratories	5E	2003	Salema, Manase Peter (TCAP)		Viljoen, Gerrit Johannes (NAFA) Crowther, John Richard (NAFA)	229580
RAS0035	Management of Technical Cooperation among Developing Countries (RCA)	0A	2003	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	997867
RAS0036	Country and Regional Programme Review	0A	2003	Salema, Manase Peter (TCAP)	Salema, Manase Peter (TCAP)	Salema, Manase Peter (TCAP)	481900
RAS0038	Role of Nuclear Power and Other Energy Options in Competitive Electricity Markets (RCA)	0E	2003	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Jalal, Ahmed Irej (NE)	228735
RAS4022	Improvement of Research Reactor Operation and Utilization, Phase II (RCA)	4B	2003	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Paranjpe, Shrinivas Krishnarao (NAPC)	209975
RAS4023	Repair and Refurbishment of Nuclear Instruments, Phase II	4G	2003	Lutfi, Nabil (TCAP)	Lutfi, Nabil (TCAP)	Kaufmann, Herbert (NAPC)	316670
RAS6038	Strengthening Medical Physics through Education and Training (RCA)	6F	2003	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	McLean, Ian Donald (NAHU)	477264
RAS7011	Enhancing the Sustainability of the Marine Coastal Environment (RCA)	7F	2003	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Boisson, Florence (NAML) Jeffree, Ross A. (NAML)	305888
RAS7013	Improved Information about Urban Air Quality Management (RCA)	7L	2003	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Trinidad, Trinidad Palad (NAHU) Markowicz, Andrzej (NAAL)	810946

RAS7014	Monitoring of Food Fortification Programmes Using Nuclear Techniques	6J	2003	Sukasam, Kesrat (TCAP)	Sukasam, Kesrat (TCAP)	Lagoda, Pierre Jean Laurent (NAFA) Trinidad, Trinidad Palad (NAHU)	918284
RAS8094	Optimization of Materials in Industry Using Online Bulk Analysis Techniques (RCA)	8A	2003	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Jin, Joon-Ha (NAPC)	327934
RAS8095	Improving Regional Capacity for Assessment, Planning, and Response to Aquatic Environmental Emergencies (RCA)	8G	2003	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Scholten, Jan Christoph (NAML)	370400
RAS8096	Modification of Natural Polymers through Radiation Processing (RCA)	8H	2003	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Sampa, Maria Helena de O. (NAPC)	125911
RAS8097	Isotope Techniques for Groundwater Contamination Studies in Urbanized and Industrial Areas (RCA)	8M	2003	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Kulkarni, Kshitij Mahadev (NAPC)	462337
RAS9028	Development of an Asian Nuclear Safety Network	9A	2003	Lutfi, Nabil (TCAP)	Lutfi, Nabil (TCAP)	Lederman, Luis (NS)	219490
RAS9029	Harmonization of Radiation Protection, Phase IV (RCA)	9C	2003	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	O'Donnell Torroba, Patricio Alfonso (NSRW) Mrabit, Khammar (NSRW)	779884
RAS9031	Assessment of Radiological Risks (RCA)	9L 9C	2004	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Telleria, Diego Miguel (NSRW) Berkovskyy, Volodymyr (NSRW) O'Donnell Torroba, Patricio Alfonso (NSRW)	224709
RAS9032	Radiological Emergency Response (RCA)	9L 9C	2004	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Zombori, Peter (NS) Mc Kenna, Thomas (NSRW) O'Donnell Torroba, Patricio Alfonso (NSRW)	204647
INT5149	Training Course on the Use of the Sterile Insect and Related Techniques	5D	2005	Boussaha, Ali (TCAF)	Boussaha, Ali (TCAF)	Hendrichs, Jorge Pedro (NAFA)	225000
RAS0041	Tracing Future Sustainable Paths through Nuclear and Other Energy Options (RCA)	0E	2005	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Jalal, Ahmed Irej (NE)	274590

RAS4024	Radioisotope Production and Neutron Beam Applications (RCA)	4B	2005	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Paranjpe, Shrinivas Krishnarao (NAPC) Pillai, Maroor Raghavan Ambikalmajan (NAPC) Fulajtar, Emil (NAFA)	335763
RAS5043	Sustainable Land Use and Management Strategies for Controlling Soil Erosion and Improving Soil and Water Quality (RCA)	5B	2005	Dias, Mahendra Prinath (TCAP) Kim, Myung Ro (TCAP)			227440
RAS5044	Integrated Approach for Improving Livestock Production Using Indigenous Resources and Conserving the Environment (RCA)	5E	2005	Dias, Mahendra Prinath (TCAP) Kim, Myung Ro (TCAP)		Boettcher, Paul John (NAFA) Vercoe, Philip Edward (NAFA)	441200
RAS6040	Improvement in Quality of Radiotherapy for Frequent Cancers in the Region (RCA)	6C	2005	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Rosenblatt, Eduardo (NAHU) McLean, Ian Donald (NAHU)	893346
RAS6041	Preventing Osteoporosis and Promoting Bone Mass in Asian Populations Using a Food-based Approach (RCA)	6J	2005	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Davidsson, Lena Margareta (NAHU)	398180
RAS6042	Tumour Imaging Using Radioisotopes (RCA)	6B	2005	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Watanabe, Naoyuki (NAHU)	400020
RAS6043	Regional Screening Network for Neonatal Hypothyroidism, Phase II	6B	2005	Kamel, Reyad Sherif (TCAP)	Kamel, Reyad Sherif (TCAP)	Solanki, Kishor K. (NAHU)	409070
RAS8098	Radiation Technology for Development of Advanced Materials and for Protection of Health and the Environment (RCA)	8J	2005	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Sampa, Maria Helena de O. (NAPC)	275560
RAS8099	Radioisotope Technology for Natural Resource Exploration and Exploitation (RCA)	8J	2005	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Jin, Joon-Ha (NAPC)	323350
RAS8100	Advanced Industrial Radiography (RCA)	8P	2005	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Einav, Isaac (NAPC)	243530
RAS9033	Developing Technical Capabilities for the Protection of Health and Safety of Workers Exposed to Ionizing Radiation	9I 9C 9J	2005	Dey, Sujit (TCAP)	Dey, Sujit (TCAP)	Deboodt, Pascal P. A. (NSRW) O'Donnell Torroba, Patricio Alfonso (NSRW) Mrabit, Khammar (NSRW)	197650

RAS9034	Strengthening Radiological Protection of Patients and Medical Exposure Control	9J	2005	Dey, Sujit (TCAP)	Dey, Sujit (TCAP)	Rehani, Madan Mohan (NSRW) O'Donnell Torroba, Patricio Alfonso (NSRW) Mrabit, Khammar (NSRW)	338993
RAS9035	Establishment of National Capabilities for Response to a Radiological and Nuclear Emergency	9L	2005	Dey, Sujit (TCAP)	Dey, Sujit (TCAP)	Zombori, Peter (NS) O'Donnell Torroba, Patricio Alfonso (NSRW)	251900
RAS9036	Strengthening National Regulatory Infrastructure for the Control of Radiation Sources	9T 9C	2005	Dey, Sujit (TCAP)	Dey, Sujit (TCAP)	Djermouni, Belkacem (NSRW) O'Donnell Torroba, Patricio Alfonso (NSRW) Mrabit, Khammar (NSRW)	674600
RAS9037	Education and Training in Support of Radiation Protection Infrastructure	9X 9C	2005	Dey, Sujit (TCAP)	Dey, Sujit (TCAP)	Sadagopan, Geetha (NSRW) O'Donnell Torroba, Patricio Alfonso (NSRW) Mrabit, Khammar (NSRW)	992933

Completed Regional/Interregional Projects (50)

<i>Project Number</i>	<i>Title</i>	<i>Field</i>	<i>Completed on</i>	<i>Country Officer</i>	<i>Project Responsible Officer</i>	<i>Technical Officer</i>	<i>Total Budget</i>
RAS0012	Regional/WASP Users Workshop (RCA)	0E	1993-01-29	Easey, John Frederick (TCPM)		Molina, Pablo (NENP)	23498
RAS5015	Mutation Breeding of Food Legumes	5C	1993-06-15	Aslam, Javed (TCPA)		Amano, Etsuo (NAFA)	216321
RAS4012	Nuclear Instrument Maintenance	4G	1995-10-31	Easey, John Frederick (TCPM)		Walsh, Robin L. (NAPC)	210615

RAS5020	Food Irradiation Process Control and Acceptance (RCA)	5H	1996-05-13	Easey, John Frederick (TCPM)	Loaharanu, Paisan (NAFA)	523847
RAS8071	Isotopes & Rad. for Tech. & Environ. Sustainable Devp. (RCA)	8H 8J	1998-04-17	Aleta, Carlito Ronguillo (TCPA)	Thereska, Jovan (NAPC) Gueven, Olgun (NAPC) Walsh, Michael A.R. (NAPC)	2549371
RAS7003	Radiation Sterilization of Tissue Grafts (RCA)	7E	1998-08-28	Aleta, Carlito Ronguillo (TCPA)	Tatsuzaki, Hideo (NAHU)	1050580
RAS4011	Research Reactor Utilization (RCA)	4B	1998-08-31	Aleta, Carlito Ronguillo (TCPA)	Dimic, Viktor (NAPC)	368146
RAS6022	Strengthening Nuclear Medicine in RCA Member States (RCA)	6B	1998-08-31	Aleta, Carlito Ronguillo (TCPA)	Padhy, Ajit Kumar (NAHU)	326653
RAS8068	Isotopes and Radiation in Industry and Environment (RCA)	8C 8J 8H 8E	1998-08-31	Aleta, Carlito Ronguillo (TCPA)	Thereska, Jovan (NAPC)	780874
RAS8070	Isotopes and Radiation in Industry and the Environment (RCA)	8C 8H 8G	1998-08-31	Aleta, Carlito Ronguillo (TCPA)	Thereska, Jovan (NAPC)	1006110
RAS4008	Nuclear Instrument Maintenance (RCA)	4G	1998-09-30	Aleta, Carlito Ronguillo (TCPA)	Xie, Yanfeng (NAHU)	1198709
RAS6018	Radioimmunoassay for Hepatitis B Diagnosis (RCA)	6B	1998-12-23	Aleta, Carlito Ronguillo (TCPA)	Ch'Ng, Soo Ling (NAHU)	922575
INT4133	Sharing Experience for Nuclear Power Util. in Dev. Countries	4A 4B	1999-04-12	Samiei, Massoud (NA)	Khan, Arshad Muhammad (NE) Koorapaty, Venkata Mahadeva Rao (NE)	49750
RAS0021	Nuclear Power Planning (RCA)	0A 0B 0J	1999-11-30	Aleta, Carlito Ronguillo (TCPA)	Mazour, Thomas Joseph (NENP)	165258
RAS8069	Isotopes and Radiation in Industry and the Environment (RCA)	8G 8J 8H 8N	1999-11-30	Aleta, Carlito Ronguillo (TCPA)	Thereska, Jovan (NAPC)	466434
RAS0023	Energy, Electricity and Nuclear Power Planning (RCA)	0A 0B 0J	1999-12-21	Aleta, Carlito Ronguillo (TCPA)	Mazour, Thomas Joseph (NENP) Hamilton, Bruce (NE)	410427

RAS9006	Strengthening of Radiation Protection Infrastructures (RCA)	9C	1999-12-21	Aleta, Carlito Ronguillo (TCPA)		Oresegun, Modupe Olusola (NSRW) Mrabit, Khammar (NSRW)	1597518
RAS5030	Feed Supplementation and Animal Production Strategies	5E	2000-11-29	Xu, Naicheng (TCAP)	Xu, Naicheng (TCAP)	Perera, Buthgamu Mudiyansele Amithral Oswin (NAFA) Aleta, Carlito Ronguillo (TCPA)	402890
RAS0024	Project Formulation Meetings (RCA)	0B	2001-05-31	Aleta, Carlito Ronguillo (TCPA)	Aleta, Carlito Ronguillo (TCPA)	Aleta, Carlito Ronguillo (TCPA)	384759
RAS5034	Irradiation As Sanitary & Phytosanitary Food Treatment (RCA)	5H	2001-08-27	Aleta, Carlito Ronguillo (TCPA)	Aleta, Carlito Ronguillo (TCPA)	Loaharanu, Paisan (NAFA)	175852
RAS8075	Geothermal Energy Resources and Environmental Management	8A	2001-08-27	Xu, Naicheng (TCAP)	Xu, Naicheng (TCAP)	Pang, Zhonghe (NAPC)	237149
RAS4019	Improving Research Reactor Operation and Utilization (RCA)	4B	2001-09-13	Aleta, Carlito Ronguillo (TCPA)	Aleta, Carlito Ronguillo (TCPA)	Basu, Saibal (NAPC)	192778
RAS8078	Nucleonic Control Systems and Tracers in Industry (RCA)	8C	2002-05-31	Aleta, Carlito Ronguillo (TCPA)	Aleta, Carlito Ronguillo (TCPA)	Thereska, Jovan (NAPC)	391643
RAS8080	Better Mgt of Envir & Industry Thru Isotope & Rad Tech (RCA)	8A 7J 0J	2002-07-15	Aleta, Carlito Ronguillo (TCPA)	Aleta, Carlito Ronguillo (TCPA)	Turner, Jeffrey Vaughan Vaughan (NAPC)	811067
RAS0028	Comparative Assessmt of Electricity Generation Options (RCA)	0E	2003-01-30	Aleta, Carlito Ronguillo (TCPA)	Kim, Kyoung-Pyo (TCPA)	Bui, Duy Thanh (NE)	436979
RAS4016	Disposal of Radioactive Waste from Non-Power Sources (RCA)	4O	2003-01-30	Aleta, Carlito Ronguillo (TCPA)	Kim, Kyoung-Pyo (TCPA)	Dayal, Ramesh (NEFW)	156601
RAS8089	Optimization of Mineral Resources Recovery Using Low Radioactivity Portable Nucleonic Gauges (RCA)	8C	2003-01-30	Aleta, Carlito Ronguillo (TCPA)	Aleta, Carlito Ronguillo (TCPA)	Thereska, Jovan (NAPC)	312352
RAS0033	Role of Nuclear Power and Other Energy Options in Mitigating Greenhouse Gas Emissions (RCA)	0E	2003-02-26	Aleta, Carlito Ronguillo (TCPA)	Kim, Kyoung-Pyo (TCPA)	Bui, Duy Thanh (NE)	202399
RAS4020	Improvement of Research Reactor Operation and Utilization (RCA)	4B	2003-02-26	Aleta, Carlito Ronguillo (TCPA)	Kim, Kyoung-Pyo (TCPA)	Paranjpe, Shrinivas Krishnarao (NAPC)	238067

RAS8083	Management of Marine Coastal Environmental Pollution (RCA)	8G	2003-02-26	Aleta, Carlito Ronguillo (TCPA)	Aleta, Carlito Ronguillo (TCPA)	Fowler, Scott W. (NAML) Boisson, Florence (NAML) Turner, Jeffrey Vaughan Vaughan (NAPC)	201587
RAS8086	Radiotracers/Sealed Sources/Nucleonic Gauges in Indust.(RCA)	8J	2003-02-26	Aleta, Carlito Ronguillo (TCPA)	Aleta, Carlito Ronguillo (TCPA)	Thereska, Jovan (NAPC)	532451
RAS8087	Radiation Processing Application for Agrowaste (RCA)	8H	2003-02-26	Aleta, Carlito Ronguillo (TCPA)	Aleta, Carlito Ronguillo (TCPA)	Chmielewski, Andrzej Grzegorz (NAPC)	78907
RAS7008	Quality Assurance in Radiation Sterilization of Tissue Graft (RCA)	7E	2003-04-29	Aleta, Carlito Ronguillo (TCPA)	Aleta, Carlito Ronguillo (TCPA)	Hendry, Jolyon Hindson (NAHU)	920506
RAS5029	Nuclear Techniques for the Promotion of Agroforestry Systems	5B	2003-05-30	Lutfi, Nabil (TCAP)	Lutfi, Nabil (TCAP)	Keerthisinghe, Deegala Gamini (NAFA)	390965
RAS0030	Design and Formulation of Project Proposals	0B	2003-06-25	Lutfi, Nabil (TCAP)	Lutfi, Nabil (TCAP)	Razley, Mohd. Nordin (TCPA)	667493
RAS7010	Measuring the Effectiveness of Multinutrient Supplementation	7J	2003-12-31	Lutfi, Nabil (TCAP)	Lutfi, Nabil (TCAP)	Iyengar, Govindaraja Venkatesha (NAHU)	475399
RAS0025	Technical Co-operation Among Developing Countries (RCA)	0A	2004-04-30	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	490260
RAS5037	Mutational Enhancement for Genetic Diversity in Rice (RCA)	5C	2004-04-30	Dias, Mahendra Prinath (TCAP)	Kim, Kyoung-Pyo (TCPA)	Shu, Qingyao (NAFA)	335110
RAS0029	Radiation Protection and Networking (RCA)	0F	2004-05-20	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Sadagopan, Geetha (NSRW)	176735
RAS2009	Quality Assurance and Good Manufacturing Practice for Radiopharmaceuticals	2G	2004-05-20	Lutfi, Nabil (TCAP)	Lutfi, Nabil (TCAP)	Pillai, Maroor Raghavan Ambikalmajan (NAPC)	322754
RAS4017	Maintenance and Repair of Nuclear Instruments	4G	2004-05-20	Lutfi, Nabil (TCAP)	Lutfi, Nabil (TCAP)	Kaufmann, Herbert (NAPC)	596355
RAS6028	Nuclear Medicine Applications (RCA)	6B	2004-05-20	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Padhy, Ajit Kumar (NAHU) Solanki, Kishor K. (NAHU)	1932912

RAS6027	Quality Assurance in Radiation Therapy (RCA)	6C	2004-08-27	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Vikram, Bhadrasain (NA) Shortt, Kenneth Robert (NAHU) Pernicka, Frantisek (NAHU)	774115
RAS8076	Better Management of Environment and Industrial Growth - Joint UNDP/RCA (RCA)	8A	2004-08-27	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Yonezawa, Chushiro (NAHU) Boisson, Florence (NAML) Markowicz, Andrzej (NAAL) Pang, Zhonghe (NAPC) Kemppainen, Markku (TCPC) Chmielewski, Andrzej Grzegorz (NAPC) Jin, Joon-Ha (NAPC)	1045640
RAS8082	Isotopic and Related Techniques to Assess Air Pollution - Joint UNDP/RCA (RCA)	8G	2004-08-27	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Markowicz, Andrzej (NAAL) Yonezawa, Chushiro (NAHU)	573112
RAS9018	Harmonization of Radiation Protection (RCA)	9C	2004-10-29	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Djermouni, Belkacem (NSRW) Mrabit, Khammar (NSRW)	1805756
RAS2010	Quality Assurance and Quality Control of Nuclear Analytical Techniques	2C	2005-02-28	Lutfi, Nabil (TCAP)	Lutfi, Nabil (TCAP)	Roszbach, Matthias H. (NAPC)	420013
INT4134	Integrated Nuclear Power and Desalination System Design	4D	2005-06-30	Kurghinyan, Vladimir (TCEU)	Kurghinyan, Vladimir (TCEU)	Misra, Braj Mohan (NENP) Methnani, Mabrouk (NENP)	333230
RAS8085	Non-Destructive Testing and Evaluation (RCA)	8C	2005-06-30	Dias, Mahendra Prinath (TCAP)	Dias, Mahendra Prinath (TCAP)	Einav, Isaac (NAPC)	229418
RAS6032	Regional Screening Network for Neonatal Hypothyroidism	6B	2005-12-28	Kamel, Reyad Sherif (TCAP)	Kamel, Reyad Sherif (TCAP)	Solanki, Kishor K. (NAHU)	619108

Cancelled Regional/Interregional Projects (1)

Project Number	Title	Field	Cancelled On	Country Officer	Project Responsible Officer	Technical Officer	Total Budget
RAS0034	Graduate Training and Education in Nuclear Sciences	01	2006-02-24	Lutfi, Nabil (TCAP)	Lutfi, Nabil (TCAP)	Salema, Manase Peter (TCAP) Lutfi, Nabil (TCAP)	0

¹ “Progress in Technology Development for Conversion of Mo-99 Production-BATAN’s (Indonesia) Conversion Program...,” May 2005, http://www.rertr.anl.gov/RERTR27/PDF/S8-5_Bakel.pdf.

² “RPI-10, the Indonesian 10 MW Isotope Production Reactor,” International Group on Research Reactors (IGORR) News, No. 9, June 1997, <http://www.igorr.com/newsletters/igorr-nl09/igorr3.html>

³ Jakarta Post, 28 June 2006.

⁴ http://www.usembassyjakarta.org/econ/ESTH_highlight_may_june06.html

⁵ IAEA Technical Cooperation Projects Database (TC-PRIDE), Project Nos. INS/3/006, INS/3/009, INS/3/009, and INS/3/011

⁶ IAEA World Distribution of Uranium Deposits Database (UDEPO)

⁷ IAEA Nuclear Fuel Cycle Information System (<http://www-nfcis.iaea.org>); see also Kosim Affandi et al., “Tinjauan Proses Pengendapan Konsentrat Uranium Skala Pilot” [“Assessment of Uranium Concentrate Precipitation of on a Pilot Scale”], Prosiding Seminar Pranata Nuklir and Litkayasa, 2 September 1998 (Abstract in English available as abstract number 0910 on BATAN digital library Web site, <http://digilib.batan.go.id/sipulitbang/sipulitbang.php>)

⁸ IAEA Technical Cooperation Projects Database (TC-PRIDE), Project No. INS/3/007.

⁹ Indonesia Country Profile, Stockholm International Peace Research Institute (SIPRI) Countries of Strategic Nuclear Concern, <http://www.sipri.org/contents/expcon/cnsc3ins.html>, citing the following reference which no longer is available at the indicated URL: <http://www.grdc.esdm.go.id/Product/map/Kalimantan/Nangapinoh-des.asp>.

¹⁰ PTNBR Web site, <http://www.batan-bdg.go.id>

¹¹ IAEA Technical Cooperation Projects Database (TC-PRIDE), Project Nos. INS/4/015 and INS/4/017.

¹² <http://www.batan.go.id/ptapb/index-e.php>

¹³ <http://www.batan.go.id/en2006/facilities.php>

¹⁴ <http://www.batan.go.id/patir>

¹⁵ “Countries of Strategic Concern: Indonesia,” SIPRI, July 2004, <http://www.sipri.org/contents/expcon/cnsc3ins.html>

¹⁶ “International GNEP Assessment: Indonesia,” pp. 5-6.

¹⁷ “Nuclear Knowledge Management, Indonesia: National Nuclear Authorities,” <http://www.iaea.org/inis/ws/countries/indonesia.html>

¹⁸ “International GNEP Assessment: Indonesia,” p. 8.

¹⁹ BATAN National Nuclear Agency, http://www.batan.go.id/batan/index_e.html

²⁰ “Nuclear Authorities in Indonesia,” http://www.iaea.org/inis/ws/nuclear_authorities/indonesia.html

-
- ²¹ Ministry of Research and Technology: Organization,
http://www.ristek.go.id/english/organization.html?bcsi_scan_3ED561A05223E3E3=0&bcsi_scan_filename=organization.html
- ²² “Asian Nuclear Safety Network,” <http://ansn.bapeten.go.id/>
- ²³ “IRTR Program Country Plan: Indonesia,” FY06 Rev 0, 1 October 2005.
- ²⁴ Ibid., pp.2-6.